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NOTES ON THE GEOLOGY OF LONG ISLAND.*

IN the investigation of the underground water resources of Long Island, which has recently been undertaken by the Division of Hydrology, U. S. Geological Survey, a number of new points have been developed which are of interest at this time. Among these are:

1. Proof of the absence of a uniform 'blue clay floor.'
2. The presence of deposits of an earlier ice advance which indicate old deeply buried channels extending 225 feet below sea level.
3. The presence of erosion remnants of a topography of pre-Pleistocene origin extending undisturbed to a height of at least 360 feet above sea level.
4. The considerable number of deep flowing wells on the north shore.

The idea that there is a fairly uniform bed of blue clay of probable Chesapeake Miocene age, which dips gently southward from its outcrop on the north shore has been demonstrated incorrect by well records obtained through the work of the Commission on Additional Water Supply, and from other sources. These have also indicated that that part of the clay bed which underlies the southwestern part of the island is Pleistocene since it is underlain by glacial beds. Several clay beds of different age have evidently been connected in the attempt to get a clay bed having a stratigraphic unity.

The examination of well samples, particularly those from the test wells of the Brooklyn Water Works, has shown in the southern part of the island, west of Valley Stream, old glacial deposits lying unconformably on an old topography, and separated from the recent glacial material by thick beds of blue clay and sands not of recognizable glacial origin. In the western part of Brooklyn these older glacial beds have been found at a depth of 225 feet *below sea level*, and are believed to throw important light on the question of early Pleistocene elevation and subsequent submergence,

as well as on the position of former stream valleys.

The last ice advance found a rather irregular topography and succeeded in covering the older hills with a veneer which is for the most part quite thin. Along the backbone of the island these deposits are much thinner than has been supposed, the really prominent portions of the ridge seeming to owe their prominence more to the preglacial hills than to morainic deposits. The most marked example of this is in the West Hills, lying in the center of the island, between Farmingdale, Melville, Cold Spring Harbor and Hicksville. Here there is a marked southward tongue of hills projecting from the east and west ridge. Glacial material covers the northward slope, and reaches a height of over 400 feet; but the southern portion of the ridge has not been covered with ice and is clearly not glacial. The following section just west of Melville indicates something of its structure.

SECTION JUST WEST OF MELVILLE, NEW YORK.

Top of section about 300 feet A. T.	Feet
1. Horizontally bedded yellow sand and quartz gravel with a few very much weathered compound pebbles. Near the upper part of the section the gravel is very bright orange.....	38
2. Covered	3
3. Dark-colored, lavender, green and black sandy clay, weathering yellow.....	6
4. Horizontally bedded, finely laminated, red arkose with a few rounded quartz pebbles. Weathering product of bed below	2.5
5. Horizontally bedded, finely laminated, green, white and pink arkose.....	3
6. Ferruginous sandstone	0.3
7. Yellow sand with ferruginous plates....	0.5
8. Irregularly bedded, gray, clayey sand blotched with red and yellow becoming more sandy above and passing into a pink or red sand with lens-shaped masses of white clay.....	9.5
9. Covered	0.5
10. White clayey sand with large quartz gravel	2
11. Covered	1
12. Stratified orange-colored sandy clay with ferruginous plates	1

* Published by permission of the Director of the U. S. Geological Survey.

13. Very black sand and gravel, probably stained with manganese dioxide..... 0.2
 14. Coarse white sand and yellow clayey sand horizontally though rather irregularly bedded; the bedding lines being darker and rather more clayey than the rest.. 18

Mr. M. L. Fuller has found in the supposed morainic hills near Old Westbury, covered by only two feet of morainic deposits, gravel beds which are clearly of the same age as those capping the West Hills, a conclusion which is further supported by a rather complete series of samples from a well near this point obtained by Mr. Isaiah Bowman. Mr. Bowman has also found a section near the top

At the heads of all the deep reentrant bays on the north shore there are many comparatively shallow flowing wells which seem to owe their origin to the steepness of the slope of the water table at these places, and to the difference in the resistance offered to the passage of water through the sands and through an open pipe, as well as to local clay beds. There are, however, a number of comparatively deep wells which are decidedly interesting in the face of the positive statement that a catchment area in Connecticut for wells on Long Island is impossible. Mr. Bowman has assisted in the collection of the following data regarding these wells:

Peacock Point.

C. O. Gates.....	230 feet.	Elevation approximately 6 feet above high tide. Flows 30 gallons per minute.
C. O. Gates.....	210 "	Elevation approximately 10 feet. Flowed when first completed 40 gallons per minute. Is now being pumped.
C. O. Gates.....	225 "	Flows 10 gallons per minute.
W. D. Guthrie.....	340 "	Elevation about 10 feet. Flows 10 gallons per minute.
Mill Neck.		
Irving Cox	330 "	Elevation about 10 feet. Flows 72 gallons per minute.
Bayville.		
Dr. O. L. Jones	276 "	Flows.
Centre Island.		
A. K. Wetmore	318 "	Elevation approximately 3 feet. Flows 25 gallons per minute at high tide.
Colgate Hoyt	320 "	Elevation approximately 4 feet. Flows.
S. T. Shaw.....	292 "	Elevation approximately 5 feet. Flows 5 to 6 gallons at high tide. Flows slightly at low tide.
C. S. Sherman	351 "	Elevation approximately 4 feet. Flows 30 gallons at high tide, 20 at low tide.
G. M. Fletcher	370 "	Elevation approximately 10 feet. Flows 25 to 30 gallons at high tide.
G. C. MacKenzie	379 "	Elevation approximately 4 feet. Flows 75 gallons at high tide, 45 at low.
Lloyds Neck.		
Dr. O. L. Jones.....	248 "	Elevation approximately 5 feet. Flows 5 gallons at high tide.

of these hills which shows a very marked non-conformity between the thin coating of recent till and these underlying yellow- and orange-colored gravels. It is believed that the stratified gravel beds which Woodworth found capping Harbor Hill, near Roslyn (elevation 384 feet), belong to the same deposits, and that this hill is not of morainic origin.

Mr. Fuller has found a number of flat top terraces south of the moraine, which have something of the elevation of the Manhasset terraces north, suggesting their extension beneath the moraine.

Dip calculations based on data furnished by these wells give very uniform results showing a dip of about S. 23° E. sixty-five feet per mile, and as quite heavy clay beds have been found in all these wells overlying the water-bearing gravel, an insular source for this water seems almost impossible.

The investigations have hardly progressed far enough for very definite conclusions to have been reached regarding exact age and structural relations, but we hope that some of these points may be cleared up before the close of the season. A. C. VEATCH.